

Lake and River Enhancement Program (LARE)
Division of Soil Conservation
Indiana Department of Natural Resources

FACTORS AFFECTING AND ESTIMATED COST OF AQUATIC PLANT CONTROL IN INDIANA LAKES

(Revised 12/11/98)

How many lakes are affected by a potential need for plant control?

- According to records kept by the IDNR Division of Fish & Wildlife, there are **616 lakes in 31 northern Indiana counties and 95 lakes in 54 southern counties**. The northern lakes totaled 58,981 acres and the southern lakes totaled 67,438 acres. During 1998, 160 permits were issued by the IDNR for aquatic plant control in Indiana.
- In a survey of fisheries biologists and chemical control companies conducted by the IDNR Division of Soil Conservation, **Eurasian water milfoil was reported from 173 lakes or 56 percent (33,006 acres) of the total lake surface area in this region**. In comparison, the Wisconsin DNR lists approximately 190 inland lakes with milfoil as of November 1994. This is a relatively small percentage of the 3,620 Wisconsin lakes that are larger than 20 acres. In 1996, Minnesota Sea Grant researchers identified 75 lakes in that state containing milfoil, primarily in the Minneapolis / St. Paul metropolitan area.
- The **counties with lakes for which aquatic plant control permits have been issued** are indicated on Figure 1 and listed in Table 1 with the total number of lakes in each county, the number of lakes with reported milfoil, and the number of lakes in the county which received a permit for plant control in 1998.
- **Significant differences were identified between northern and southern Indiana lakes that were treated for aquatic plants**. In comparison to lakes treated in southern Indiana, Northern Indiana lakes were twice as deep, had a lower number of shoreland homes, more forested shoreland, greater abundance of curlyleaf pondweed, much smaller percentage of surface area treated, over 10 times the proportion of surface treated for milfoil, over three times the surface treated for curlyleaf pondweed and less surface treated for native plants (Table 2).

What factors are the most consistent indicators of nuisance plant problems?

Several ecological and social factors appeared to have a relationship to a larger number of **plant control permit requests in northern Indiana lakes** (i.e., statistical significance level greater than 80 percent) and are listed in order of statistical significance from greater to lesser relationship. Statistical values are given in Table 3. Data related to water chemistry and lakeshore use were from research conducted by the Indiana Clean Lakes Program, IDEM / IU-

SPEA. Statistics tests are preliminary. A spreadsheet with raw data is available from the IDNR Division of Soil Conservation.

- ✓ **Lakes with more shallow area (mean depth).** Aquatic plants cannot grow in deeper water due to lack of light. Therefore, shallower lakes have a larger surface area over which plants can grow. However, water clarity may override depth as a primary factor in controlling available light and plant growth.
- ✓ **Greater number of lakefront homes.** Highly populated lakes may have more residents with an interest in and funding for aquatic plant control. More boat traffic on lakes may spread nuisance plants by fragmentation within the lake or from other lakes. Highly developed lakes may have characteristics that contribute to an overabundance of plants.
- ✓ **Not dominated by bluegreen algae.** More algae is generally associated with fewer rooted plants. Bluegreen algae tend to dominate lakes that have very high nutrients and are often associated with poorly managed landscapes. Bluegreen algae can form dense clouds or scum in the water, which reduces aquatic plant growth by preventing light and nutrients from reaching aquatic plants. Unlike other groups of algae, bluegreens do not contribute to the food web.

Lakes treated for aquatic plants had some distinguishing regional characteristics. For instance, northern lakes receiving permits for plant treatment were larger than average (310 acres vs. 98 acres) and represented 38 percent (22,276 acres) of the total lake surface area in the region.

The following factors did not appear to have a strong relationship to aquatic plant control problems (i.e., statistical significance level less than 50 percent) and are listed in order of statistical significance from greater to lesser relationship. As each of the following factors increased, the number of aquatic plant control permits decreased.

- ✓ Forested shoreline area.
- ✓ Wetland shoreline area.
- ✓ Water clarity (Secchi depth).
- ✓ Eutrophication index.
- ✓ Total phosphorus.
- ✓ Total phytoplankton concentration.

To what extent are exotic or native species the target for control?

- Permits were issued for plant control on 1,989 acres. An average permit indicated plans for treating **11 percent of lake surface area on northern lakes and 52 percent of area in southern lakes.** The depth of shoreline treatment was similar statewide with an average of 5-6 ft and a maximum of 10-12 ft. The area allowed for treatment may be smaller than the lake resident desires due to the amount of money available and in order to provide adequate vegetation for fisheries and water quality protection.
- **One invasive plant, Eurasian water milfoil, was a primary target for control at northern lakes that received permits.** The average portion of the treatment area that contained Eurasian water milfoil was 84 percent. Southern lakes were usually treated for

native plant growth. Algae was a common target statewide. A list of species commonly treated is presented in Table 4.

- **Distribution of nuisance exotic plants may be related to region and human use.** A draft report on the St. Joseph River basin indicated that “lakes with public access sites have a greater tendency to have problem densities of weeds, because species are transferred by boats and trailers” (Wesley and Duffy, 1998). This pattern was also indicated in a recent survey of Eurasian milfoil distribution in Indiana (White, 1998). Eurasian watermilfoil and curly-leaf pondweed were prevalent in lakes in the northern tier of counties and all northeastern counties in which glacially-formed natural lakes occur. Eurasian milfoil occurred in reservoirs across the central portion of the state that were generally located in state parks with high recreational use and were near large metropolitan areas (Terre Haute, Richmond, Bloomington, and Washington). Exotic aquatic plants were not reported from reservoirs in the upper Wabash River watershed in north central Indiana or from the southern counties along the Ohio River and in the lower Wabash River watersheds.

What is the estimated current and potential cost for chemical plant control?

An estimated \$803,041 is spent each year for aquatic plant control in Indiana lakes.

Reward and 2,4-D constituted over 60 percent of the cost for chemicals with over 60,000 pounds of 2,4-D applied. Details on chemical use are given in Table 5. Based on the surface area of lakes where presence of Eurasian water milfoil was reported and current application rates, the annual demand for plant control in Indiana lakes would be over **\$1,224,000**. This number could be a very conservative estimate of actual demand or of control costs for nuisance species. These estimates do not include state resources spent on treating aquatic plants on state owned properties or public lakes through the IDNR Divisions of Fish and Wildlife or State Parks and Reservoirs.

References

- Pearson, J. et al. 1991. Aquatic Plant Control in Indiana Public Freshwater Lakes. Aquatic Plant Committee Report. Indiana Department of Natural Resources.
- Wesley, J.K., and J.E. Duffy. 1998. St. Joseph River Assessment. Draft. Michigan Department of Natural Resources, Fisheries Division.
- White, G.M. 1998. Exotic Plant Species in Indiana Lakes. Report prepared for the Nonindigenous Aquatic Species Database, USGS, Gainesville, Florida. Indiana Department of Natural Resources, Division of Soil Conservation.

Table 1a. The seventeen Northern Indiana counties which contain lakes with reported Eurasian water milfoil. Values given are for the total number of lakes in each county, the number of lakes with reported milfoil, the number of lakes in the county which received a permit for plant control, and the percent of lakes reporting milfoil that were treated in 1998.

<u>County</u>	<u># of lakes</u>	<u># reported milfoil</u>	<u># of permit lakes</u>	<u>% milfoil treated</u>
Noble	121	29	14	48
Steuben	93	33	10	30
Kosciusko	73	36	24	67
Lagrange	62	24	12	50
Lake	28	1		0
LaPorte	26	4	2	50
Whitley	25	12	4	33
Porter	23	4	1	25
St. Joseph	23	2	2	100
Elkhart	22	6		0
Allen	19	1		0
Fulton	17	6	2	33
Marshall	16	8		0
Wabash	11	1		0
Dekalb	9	3	1	33
Starke	7	2	1	50
Cass	2	1		0
Total:	616	173	73	Average: 31%

Table 1b. The ten Southern Indiana counties which contain lakes receiving a plant control permit with the total number of lakes in each county, the number of lakes with reported Eurasian water milfoil, the number of lakes in the county which received a permit for plant control, the percent of lakes reporting milfoil that were treated in 1998, and statewide totals and average for these factors.

<u>County</u>	<u># of lakes</u>	<u># reported milfoil</u>	<u># of permit lakes</u>	<u>% milfoil treated</u>
Daviess	29		1	
Fayette	1		1	
Henry	6		1	
Marion	6		11	
Martin	4		1	
Monroe	12	1	1	100
Vigo	11		5	
Warrick	2		1	
Washington	20		2	
Wayne	4	1	1	100
Total:	95	2	25	100%
STATE TOTAL: 711		175	98	STATE AVE: 40%

Table 2. Comparison by region of morphometry, water quality, and land use around lakes receiving permits for aquatic plant treatment in 1998. The first value given is for total number of lakes in the DNR Fisheries Section database. All subsequent values pertain only to lakes receiving a plant control permit in 1998, including number of lakes, total surface area, and average of the following: size, maximum depth, mean depth, Eutrophication Index, Secchi depth, total phosphorus, percent bluegreen algae in the phytoplankton, # of homes visible from the lake, percent of shoreline in wetlands, percent of shoreline in forest, reported rating for milfoil abundance, and reported rating for curlyleaf pondweed abundance. (sig. = statistical significance level or “p”)

Factor	North	South	t	p	sig.
total number of lakes	616	95	--	--	--
number of treated lakes	73	25	--	--	--
total surface area treated lakes	22,276	2,865	--	--	--
average size	309	159	1.240	0.4	
maximum depth	50	24	3.013	0.01	**
mean depth	19	12	1.839	0.1	
Number of shoreland homes	77	90	7.169	0.001	***
Percent shoreland wetland	8	4	0.841	0.5	
Percent shoreland forest	12	64	6.147	0.001	***
Eutrophication Index (EI)	33	36	0.393	0.9	
Secchi depth (clarity)	6.2	5	0.865	0.4	
Total phosphorus	0.160	0.058	1.500	0.2	
Percent bluegreen algae	56	69	1.107	0.4	
Eurasian milfoil rating	2.7	1.9	1.672	0.1	
Curlyleaf pondweed rating	1.8	0.8	2.823	0.01	**
% treated surface	11	52	7.330	0.001	***
% treated area for milfoil	84	8	11.237	0.001	***
% treated area for native plants	34	53	2.078	0.05	*
% treated area for algae	69	82	1.340	0.2	
% treated area for curlyleaf	43	13	3.189	0.001	***

Table 3. Statistical relationships between various factors related to plant control in Northern Indiana lakes. (Secchi = Secchi depth; plankton = total plankton concentration; depth = mean depth; % trt = percent of lake area treated; tot P = total phosphorus concentration; # homes = number of lakefront homes; %BG = percent of phytoplankton represented by bluegreen algae; forest = percentage of lakefront visible from the center of the lake that is forested; wetland = percentage of lakefront visible from the center of the lake that is wetland; EI = eutrophication index)

	<u>Pearson's r</u>	<u>n1</u>	<u>n2</u>	<u>y</u>	<u>t</u>	<u>p</u>
Secchi x plankton	-0.2915	70	68	66	-2.476	0.02
depth x % trt	-0.2294	66	69	64	-1.885	0.1
depth x tot P	-0.2246	66	70	64	-1.844	0.1
# homes x % trt	0.2150	44	69	42	1.426	0.2
%BG x % trt	-0.2026	68	69	66	-1.680	0.2
forest x % trt	-0.1190	44	69	42	-0.777	0.5
wetlands x % trt	-0.1100	44	69	42	-0.717	0.5
Secchi x % trt	-0.0950	70	69	67	-0.781	0.5
EI x % trt	-0.0793	66	69	64	-0.636	0.9
tot P x % trt	-0.0664	70	69	67	-0.545	0.9
plankton x % trt	-0.0500	68	69	66	-0.407	0.9

Table 4. Plant species targeted for chemical treatment in permits issued during 1998.

<u>Common name</u>	<u>Scientific name</u>	<u>Treatment area (acres)</u>
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	1,774
Filamentous algae	<i>Spyrogyra</i> , <i>Cladophora</i> , etc.	1,429
Coontail	<i>Ceratophyllum demersum</i>	367
Curlyleaf pondweed (exotic)	<i>Potamogeton crispus</i>	315
Muskgrass	<i>Chara spp</i>	142
Others listed:		
Southern naiad	<i>Najas guadalupensis</i>	---
Clasping-leaf pondweed	<i>Potamogeton Richardsonii</i>	---
Sago pondweed	<i>Potamogeton pectinatus</i>	---
American elodea	<i>Elodea canadensis</i>	---

Table 5. Total quantity (gallons or pounds) of chemicals listed for use in the lake from permit applications in 1998, percentage of lakes with permits that included each chemical, and the 1995 total cost of the chemical purchase. *Note that these are bulk prices as of three years ago as listed in a supply catalogue from Aquatic Control, Seymour, Indiana.* (quantity = total amount listed on the permit in gallons or pounds)

Chemical	cost/unit	Quantity North	Quantity South	Cost North	Cost South
Aquakleen (lbs)	\$ 1.89	2,450	0	\$ 4,631	\$ 0
Aquathol K (gal)	43.84	1,312	334	57,518	14,643
Aquathol K (lbs)	1.89	1,000	4,080	1,890	7,712
Cleargate (gal)	30.00	119	0	3,570	0
Copper sulfate (lbs)	0.85	10,115	5,136	8,598	4,366
Citrine Plus (gal)	1.53	10	464	15	710
Hydrothol 191 (gal)	48.10	377	25	18,134	1,203
Hydrothol 191 (lbs)	1.89	200	0	378	0
Komeen (gal)	17.75	171	0	3,035	0
Navigate (lbs)	2.15	14,000	0	30,100	0
Pondmaster (gal)	168.20	1	0	168	0
Reward (gal)	90.62	1,330	43	120,525	3,897
Rodeo	107.66	0	13	0	1,346
Sonar (gal)	1,278.00	26	2	33,228	2,556
2,4-D (lbs)	2.09	61,847	0	129,260	0
Total value of chemicals on permits:				\$411,050	\$35,084
Total number of treated lakes:				73	25
Total number of surface water acres in treated lakes:				22,276	2,865
Total number of surface water acres treated:				2,052	547
Cost of chemicals per surface acre treated:				\$200	\$64
Surface water acres in untreated lakes that report milfoil:				11,680	unknown
Estimated statewide current application costs (plus 80%):				\$803,041	
Estimated potential application costs (based on northern lakes):				\$1,224,000	

Figure 1. Counties included in the aquatic plant control analysis (Fishery Biologist Districts 1, 2, 3, and 4). Counties for which permits have been issued are indicated by hash marks.

October 23, 1998

Dear Lake Manager,

The Indiana Lakes Work Group, chaired by Senators Robert Meeks and Claire Leuck, has been discussing the potential need for state cost-share assistance in controlling nuisance aquatic plants. The Division of Soil Conservation staff has developed the enclosed preliminary report to address the potential extent of concerns related to aquatic plants.

These calculations were based in part on the reports on milfoil occurrences in Indiana lakes to which you many have contributed last year. Please feel free to check your copy of that report and email or fax any additional lakes that now contain milfoil, as well as an estimate of the abundance by using the following scale: abundant = abundant or dominant milfoil with low diversity of other plant species; common = common, but not dominant milfoil; rare = rare, occasionally noticed or scattered. If you need another copy of the milfoil report, please let me know.

As you review the enclosed document, please feel free to return comments or suggestions on how state agencies should approach this issue. The 26-member Work Group will be discussing these issues in monthly meetings in Indianapolis and will make their recommendations to the legislature and agencies in a final report due December 31, 1999. Your participation in this process regarding any lake issue would be very valuable. You can send comments to our office and we will forward them to the work group for their consideration.

Thank you for your ongoing contributions to the management of Indiana lakes!

Sincerely,

Gwen White
Aquatic Biologist

Enclosure: "Estimated cost of aquatic plant control in Northern Indiana lakes"